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MMM     MMM     TT          HH      HH      CC          SS          II       NN      NN      CC          00      00
MMM     MMM     TT          HH      HH      CC          SS          II       NN      NN      CC          00      00
MM      MM      TT          HH      HH      CC          SS          II       NNNN   NN      CC          00      00
MM      MM      TT          HH      HH      CC          SS          II       NNNN   NN      CC          00      00
MM      MM      TT          HHHHHHHHHH  CC          SSSSSS  II       NN      NN      CC          00      00
MM      MM      TT          HHHHHHHHHH  CC          SSSSSS  II       NN      NN      CC          00      00
MM      MM      TT          HH      HH      CC          SS          II       NN      NN      CC          00      00
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(2)	50	HISTORY	; Detailed Current Edit History
(3)	59	DECLARATIONS	
(4)	87	MTH\$CSIN - COMPLEX SINE	
(5)	133	MTH\$CCOS - COMPLEX COSINE	
(6)	181	WORKER - do all the work	


```
0000 1 .TITLE MTH$CSINCOS COMPLEX SINE AND COSINE
0000 2 .IDENT /1-002/ ; File: MTHCSINCO.MAR
0000 3
0000 4 :
0000 5 :*****
0000 6 :
0000 7 :* COPYRIGHT (c) 1978, 1980, 1982, 1984 BY
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0000 9 :* ALL RIGHTS RESERVED.
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0000 23 :* SOFTWARE ON EQUIPMENT WHICH IS NOT SUPPLIED BY DIGITAL.
0000 24 :
0000 25 :
0000 26 :*****
0000 27 :
0000 28 :
0000 29 : FACILITY: MATH LIBRARY
0000 30 :++
0000 31 : ABSTRACT:
0000 32 : Return the SINE of a complex number
0000 33 : Return the COSINE of a complex number
0000 34 :
0000 35 :
0000 36 :--
0000 37 :
0000 38 : VERSION: 0
0000 39 :
0000 40 : HISTORY:
0000 41 :
0000 42 : AUTHOR:
0000 43 : Jonathan M. Taylor, 19-JUL-77: Version 0
0000 44 :
0000 45 : MODIFIED BY:
0000 46 :
0000 47 :
0000 48 :
```

MTH\$CSINCOS
1-002

COMPLEX SINE AND COSINE N 10 16-SEP-1984 01:12:16 VAX/VMS Macro V04-00 Page 2
HISTORY ; Detailed Current Edit History 6-SEP-1984 11:21:26 [MTHRTL.SRC]MTHCSINCO.MAR;1 (2)

```
0000 50 .SBTTL HISTORY ; Detailed Current Edit History
0000 51
0000 52
0000 53 ; Edit History for Version 0 of MTH$CSINCO
0000 54 :
0000 55 : 1-001 - Update version number and copyright notice. The last edit
0000 56 : 1-002 - Add "" to the PSECT directive. JBS 21-DEC-78
0000 57 : number in version 0 was 3. JBS 16-NOV-78
```



```
0000 59      .SBTTL  DECLARATIONS
0000 60
0000 61 :
0000 62 : INCLUDE FILES:
0000 63 :   OERR.MAR
0000 64 :
0000 65 :
0000 66 : EXTERNAL SYMBOLS:
0000 67 :   .GLOBL  MTH$SIN_R4
0000 68 :   .GLOBL  MTH$COS_R4
0000 69 :   .GLOBL  MTH$EXP_R4
0000 70 :
0000 71 :
0000 72 : MACROS:
0000 73 :   NONE
0000 74 :
0000 75 :
0000 76 : PSECT DECLARATIONS:
0000 77 :   .PSECT  _MTH$CODE      PIC, SHR, LONG, EXE, NOWRT
0000 78 :
0000 79 :
0000 80 : EQUATED SYMBOLS:
0000 81 :   argadr  =      4      ; offset from AP of arg addr
0000 82 :
0000 83 :
0000 84 : OWN STORAGE:
0000 85 :   NONE
```

```
0000 87 .SBTTL MTH$CSIN - COMPLEX SINE
0000 88
0000 89 :++
0000 90 : FUNCTIONAL DESCRIPTION:
0000 91 :
0000 92 : MTH$CSIN computes the SINE of a COMPLEX number (r, i) as
0000 93 :
0000 94 : result = (SIN(r) * COSH(i), COS(r) * SINH(i))
0000 95 :
0000 96 : CALLING SEQUENCE:
0000 97 : Sine.wfc.v = MTH$CSIN(arg.rfc.r)
0000 98 :
0000 99 :
0000 100 : INPUT PARAMETERS:
0000 101 : The one input parameter is the address of a COMPLEX number (r, i),
0000 102 : where r and i are both single-precision floating point values.
0000 103 :
0000 104 : IMPLICIT INPUTS:
0000 105 : NONE
0000 106 :
0000 107 : OUTPUT PARAMETERS:
0000 108 : NONE
0000 109 :
0000 110 : IMPLICIT OUTPUTS:
0000 111 : NONE
0000 112 :
0000 113 : COMPLETION CODES:
0000 114 : NONE
0000 115 :
0000 116 : SIDE EFFECTS:
0000 117 : Signals: Reserved Operand if r or i are invalid (-0.0)
0000 118 : MTH$_SINSIGLOS if |r| > 2*PI*2**31.
0000 119 : Floating Overflow if i > 88.028.
0000 120 :
0000 121 :--
0000 122 :
0000 123 :
0000 124 .ENTRY MTH$CSIN, ^M<R2,R3,R4,R5,R6,R7>
0002 125 JSB WORKER ; R0 = SIN(r)
0008 126 ; R1 = COS(r)
0008 127 ; R2 = SINH(i)
0008 128 ; R3 = COSH(i)
0008 129 MULF R3, R0 ; R0 = SIN(r) * COSH(i)
0008 130 MULF R2, R1 ; R1 = COS(r) * SINH(i)
000E 131 RET
```

00000025'EF 00FC 16

50 53 44
51 52 44
04


```
000F 133      .SBTTL MTH$CCOS - COMPLEX COSINE
000F 134
000F 135      :++
000F 136      : FUNCTIONAL DESCRIPTION:
000F 137      :
000F 138      : MTH$CCOS computes the COSINE of COMPLEX number (r, i) as follows:
000F 139      :
000F 140      : result = (COS(r) * COSH(i), -SIN(r) * SINH(-i))
000F 141
000F 142      : CALLING SEQUENCE:
000F 143      : Cosine.wfc.v      = MTH$CCOS (arg.rfc.r)
000F 144
000F 145      : INPUT PARAMETERS:
000F 146      : The one input parameter is the address of a COMPLEX number (r, i),
000F 147      : where r and i are both single-precision floating point values.
000F 148
000F 149      : IMPLICIT INPUTS:
000F 150      : NONE
000F 151
000F 152      : OUTPUT PARAMETERS:
000F 153      : NONE
000F 154
000F 155      : IMPLICIT OUTPUTS:
000F 156      : NONE
000F 157
000F 158      : COMPLETION CODES:
000F 159      : NONE
000F 160
000F 161      : SIDE EFFECTS:
000F 162      : Signals:
000F 163      : Reserved Operand if r or i are invalid (-0.0)
000F 164      : MTH$_SINSIGLOS if |r| > 2*PI*2**31.
000F 165      : Floating Overflow if i > 88.028.
000F 166
000F 167      :--
000F 168
000F 169
000F 170      .ENTRY MTH$CCOS,      ^M<R2,R3,R4,R5,R6,R7>
0011 171      JSB      WORKER      : R0 = SIN(r)
0017 172      : R1 = COS(r)
0017 173      : R2 = SINH(i)
0017 174      : R3 = COSH(i)
0017 175      : R3 = COS(r) * COSH(i)
001A 176      Mulf     R0, R0      : R0 = -SIN(r)
001D 177      Mulf3    R0, R2, R1    : R1 = -SIN(r) * SINH(i)
0021 178      MOVL     R3, R0      : R0 = COS(r) * COSH(i)
0024 179      RET
```

00000025'EF 00FC 16

51 53 51 44 0017 175 MULF R1, R3

50 50 52 001A 176 MNEGF R0, R0

52 50 45 001D 177 Mulf3 R0, R2, R1

50 53 D0 0021 178 MOVL R3, R0

04 0024 179 RET


```
0025 181 .SBTTL WORKER - do all the work
0025 182
0025 183 ;+
0025 184 ; Setup error handler
0025 185 ; Compute:
0025 186 ; R0 = SIN(r)
0025 187 ; R1 = COS(r)
0025 188 ; R2 = SINH(i)
0025 189 ; R3 = COSH(i)
0025 190 ; -
0025 191
0025 192 WORKER:
0025 193 MTH$FLAG_JACKET ; set up error handler
6D 00000000'GF 9E 0025 MOVAB G^MTH$$JACKET_HND, (FP) ; set handler address to jacket
002C ; handler
002C
002C 194 MOVL argadr(AP), R0 ; R0 -> (r, i)
50 04 AC D0 002C 195 MOVF 4(R0), R0 ; R0 = i
50 04 A0 50 0030 196 JSB MTH$EXP_R4 ; R0 = EXP(i)
00000000'EF 16 0034 197 DIVF3 R0, #1.0, R1 ; R1 = EXP(-i)
51 08 50 47 003A 198
003E 199
55 50 51 43 003E 199 SUBF3 R1, R0, R5 ; R5 = EXP(i) - EXP(-i)
55 50 00 44 0042 200 MULF #0.5, R5 ; R5 = (EXP(i) - EXP(-i))/2
0045 201
56 50 51 41 0045 202 ADDF3 R1, R0, R6 ; R6 = EXP(i) + EXP(-i)
56 50 00 44 0049 203 MULF #0.5, R6 ; R6 = (EXP(i) + EXP(-i))/2
004C 204
50 04 BC 50 004C 205 MOVF @argadr(AP), R0 ; R0 = r
00000000'EF 16 0050 206 JSB MTH$COS_R4 ; R0 = COS(r)
57 50 D0 0056 207 MOVL R0, R7 ; R7 = COS(r)
0059 208
50 04 BC 50 0059 209 MOVF @argadr(AP), R0 ; R0 = r
00000000'EF 16 005D 210 JSB MTH$SIN_R4 ; R0 = SIN(r)
0063 211
51 57 D0 0063 212 MOVL R7, R1 ; R1 = COS(r)
52 55 D0 0066 213 MOVL R5, R2 ; R2 = SINH(i)
53 56 D0 0069 214 MOVL R6, R3 ; R3 = COSH(i)
006C 215
05 006C 216 RSB
006D 217
006D 218
006D 219
006D 220 .END
```

MTH\$CSINCOS
Symbol table

COMPLEX SINE AND COSINE

F 11

16-SEP-1984 01:12:16
6-SEP-1984 11:21:26

VAX/VMS Macro V04-00
[MTHRTL.SRC]MTHCSINCO.MAR;1

Page 7
(6)

ARGADR = 00000004
MTH\$\$JACKET_HND ***** X 01
MTH\$CCOS 0000000F RG 01
MTH\$COS_R4 ***** G 00
MTH\$CSIN 00000000 RG 01
MTH\$EXP_R4 ***** G 00
MTH\$SIN_R4 ***** G 00
WORKER 00000025 R 01

! Psect synopsis !

PSECT name	Allocation	PSECT No.	Attributes
ABS	00000000 (0.)	00 (0.)	NOPIC USR
_MTH\$CODE	0000006D (109.)	01 (1.)	PIC USR

CON ABS LCL NOSHR NOEXE NORD NOWRT NOVEC BYTE
CON REL LCL SHR EXE RD NOWRT NOVEC LONG

! Performance indicators !

Phase	Page faults	CPU Time	Elapsed Time
Initialization	33	00:00:00.09	00:00:01.38
Command processing	126	00:00:00.60	00:00:03.69
Pass 1	84	00:00:00.72	00:00:02.16
Symbol table sort	0	00:00:00.00	00:00:00.00
Pass 2	51	00:00:00.59	00:00:01.94
Symbol table output	2	00:00:00.01	00:00:00.37
Psect synopsis output	2	00:00:00.02	00:00:00.01
Cross-reference output	0	00:00:00.00	00:00:00.00
Assembler run totals	300	00:00:02.06	00:00:09.56

The working set limit was 900 pages.
3332 bytes (7 pages) of virtual memory were used to buffer the intermediate code.
There were 10 pages of symbol table space allocated to hold 8 non-local and 0 local symbols.
280 source lines were read in Pass 1, producing 14 object records in Pass 2.
1 page of virtual memory was used to define 1 macro.

! Macro library statistics !

Macro library name	Macros defined
_\$255\$DUA28:[SYSLIB]STARLET.MLB;2	0

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS\$:MTHCSINCO/OBJ=OBJ\$:MTHCSINCO MSRC\$:MTHJACKET/UPDATE=(ENH\$:MTHJACKET)+MS

0258

AH-BT13A-SE
VAX/VMS V4.0

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